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Claims

- [c1] 1 .A lamp comprising:
an LED module including at least one LED arranged on a substrate;
an optical system comprising at least one lens in optical communication with
the LED module; and
a zoom apparatus that selectively adjusts the relative axial separation of the
optical system and the LED module.
- [c2] 2 .The lamp as set forth in claim 1 , wherein the LED module comprises:
a plurality of LED's arranged in a first pattern on the substrate.
- [c3] 3 .The lamp as set forth in claim 2 , wherein the at least one lens comprises:
a plurality of Fresnel lens arranged in a second pattern that corresponds with
the first pattern.
- [c4] 4 .The lamp as set forth in claim 2 , wherein the optical system comprises:
a plurality of lenses wherein each lens is axially aligned with an LED and
optically communicates with said LED.
- [c5] 5 .The lamp as set forth in claim 1 , wherein the zoom apparatus comprises:
a first sleeve having the LED module arranged thereon, the first sleeve further
having a first threading arranged thereon; and
a second sleeve having a second threading arranged thereon that is adapted to
cooperate with the first threading such that the first sleeve and the second
sleeve are relatively movable in a screwing fashion, the second sleeve further
having the optical system arranged thereon.
- [c6] 6 .The lamp as set forth in claim 5 , further comprising:
an index system that relatively biases the first sleeve and the second sleeve into
one or more selectable relative axial positions.
- [c7] 7 .The lamp as set forth in claim 1 , wherein the zoom apparatus comprises:
a first element having the LED module disposed thereon; and
a second element adapted to slidingly connect with the first element, the
second element further having the optical system disposed thereon.

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- [c8] 8 .The lamp as set forth in claim 7 , wherein the zoom apparatus further comprises:
a mechanical interlock between the first and the second elements that prevents relative rotation therebetween.
- [c9] 9 .The lamp as set forth in claim 8 , wherein the mechanical interlock comprises:
a protrusion on one of the first and the second elements, the protrusion being aligned parallel to the optical axis; and
a groove on one of the first and the second elements that receives the protrusion to prevent relative rotation of the first and the second elements.
- [c10] 10 .The lamp as set forth in claim 7 , further comprising:
a stop that relatively biases the first and the second elements into one or more selectable relative axial stop positions.
- [c11] 11 .The lamp as set forth in claim 7 , wherein the LED module further comprises:
a heat sink thermally connected with the substrate for cooling the LED module.
- [c12] 12 .A light source comprising:
an LED module including a plurality of LED's for generating a lamp beam; and
an adaptive optical system for selectively adjusting the angular spread of the lamp beam.
- [c13] 13 .The light source as set forth in claim 12 , wherein the adaptive optical system comprises:
a plurality of lenses; and
one of:
two slidably interconnected sleeves, and
two threadedly interconnected sleeves,
the first sleeve being connected with the LED module, and the second sleeve being connected with the plurality of lenses.
- [c14] 14 .The light source as set forth in claim 12 , wherein the adaptive optical system comprises:

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- a plurality of lenses;
- two cylindrical threadedly interconnected sleeves, the first sleeve connected with the LED module, and the second sleeve connected with the plurality of lenses; and
- a mechanical index system that biases the threaded interconnection of the two sleeves into selectable stop positions.
- [c15] 15 .The light source as set forth in claim 14 , wherein the selectable stop positions include:
stop positions that axially align each LED of the LED module with one of the plurality of lenses.
- [c16] 16 .The light source as set forth in claim 12 , wherein the adaptive optical system comprises:
a plurality of lenses arranged into an n-fold rotationally symmetric pattern corresponding to a rotational symmetry of the arrangement of the plurality of LED's;
two cylindrical threadedly interconnected sleeves, the first sleeve having the LED module disposed therein, and the second sleeve having the plurality of lenses disposed therein; and
a stop mechanism that biases the threaded interconnection of the two sleeves into selectable stop positions that are angularly separated by integer multiples of $360^{\circ}/n$ degrees, where n corresponds to the n-fold rotational symmetry of the arrangement of the plurality of lenses.
- [c17] 17 .A lamp comprising:
a light source;
an optical system comprising at least one lens in optical communication with the light source; and
a zoom apparatus that selectively adjusts the relative axial separation of the optical system and the light source.
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- [c18] 18 .The lamp as set forth in claim 17 , wherein the zoom apparatus comprises:
one of:
two slidably interconnected sleeves, and

two threadedly interconnected sleeves,
the first sleeve having the light source arranged thereon, and the second sleeve
having the optical system arranged thereon.